Air Dispersion Modeling: What the heck is it?

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Who will you hear from?

- Jim Haywood

  Senior Meteorologist

- Jenifer Dixon

  OEA Air Specialist

Webinar Set Up

- All lines will be muted
- Questions can be sent to us via the question/chat box
- We will record webinar and post online

Modeling and Permits

You've submitted your application form, site description, technical information, and regulatory summary….

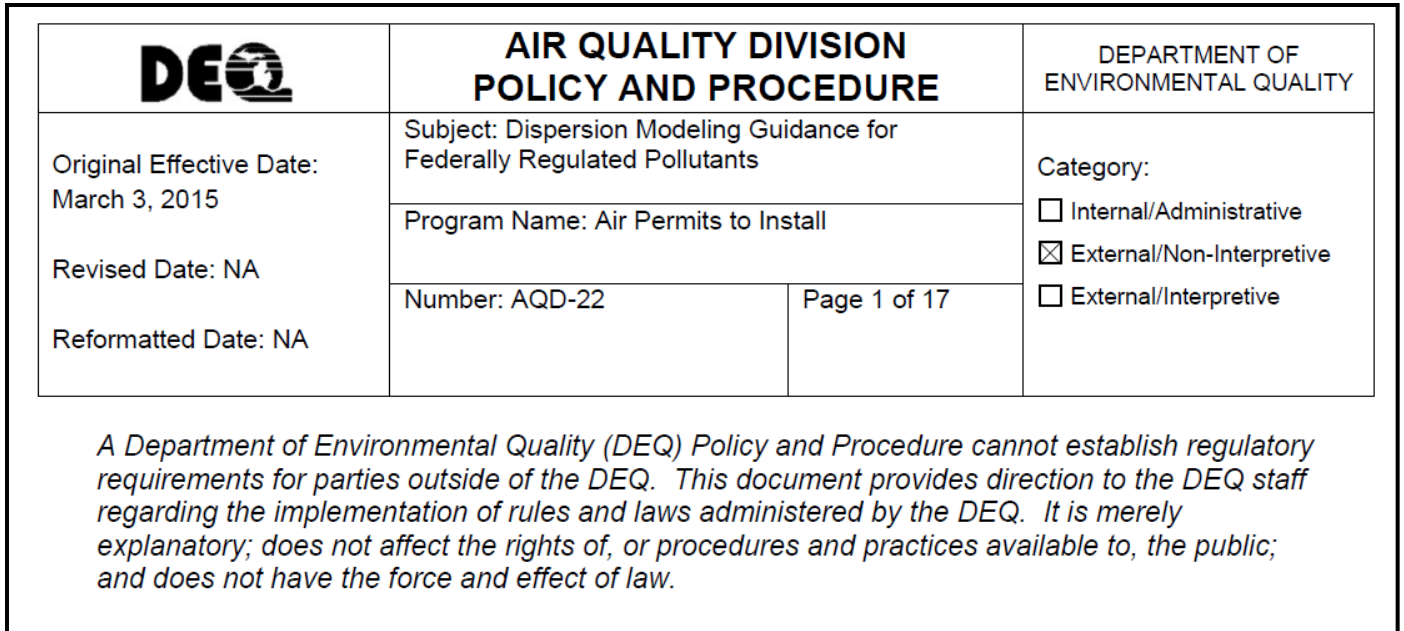
Did you consider modeling?

Modeling and Permits

AQD Permit Engineers

Why Model?

- Identify impacts from the construction or modification of facilities that are seeking a permit to install/operate air emission sources.
- AQD Policy and Procedure AQD-22 (March 3, 2015)



DEQ	AIR QUALITY DIVISION POLICY AND PROCEDURE		DEPARTMENT OF ENVIRONMENTAL QUALITY
Original Effective Date: March 3, 2015 Revised Date: NA Reformatted Date: NA	Subject: Dispersion Modeling Guidance for Federally Regulated Pollutants		Category: ☐ Internal/Administrative ☒ External/Non-Interpretive ☐ External/Interpretive
	Program Name: Air Permits to Install		
	Number: AQD-22	Page 1 of 17	

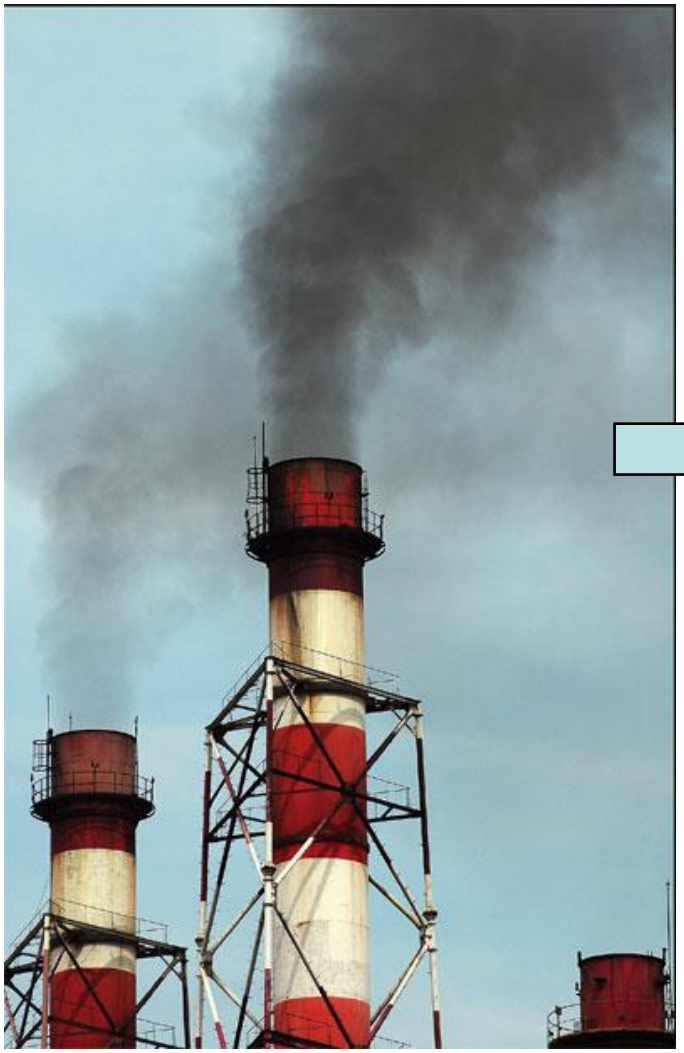
A Department of Environmental Quality (DEQ) Policy and Procedure cannot establish regulatory requirements for parties outside of the DEQ. This document provides direction to the DEQ staff regarding the implementation of rules and laws administered by the DEQ. It is merely explanatory; does not affect the rights of, or procedures and practices available to, the public; and does not have the force and effect of law.

When Model?

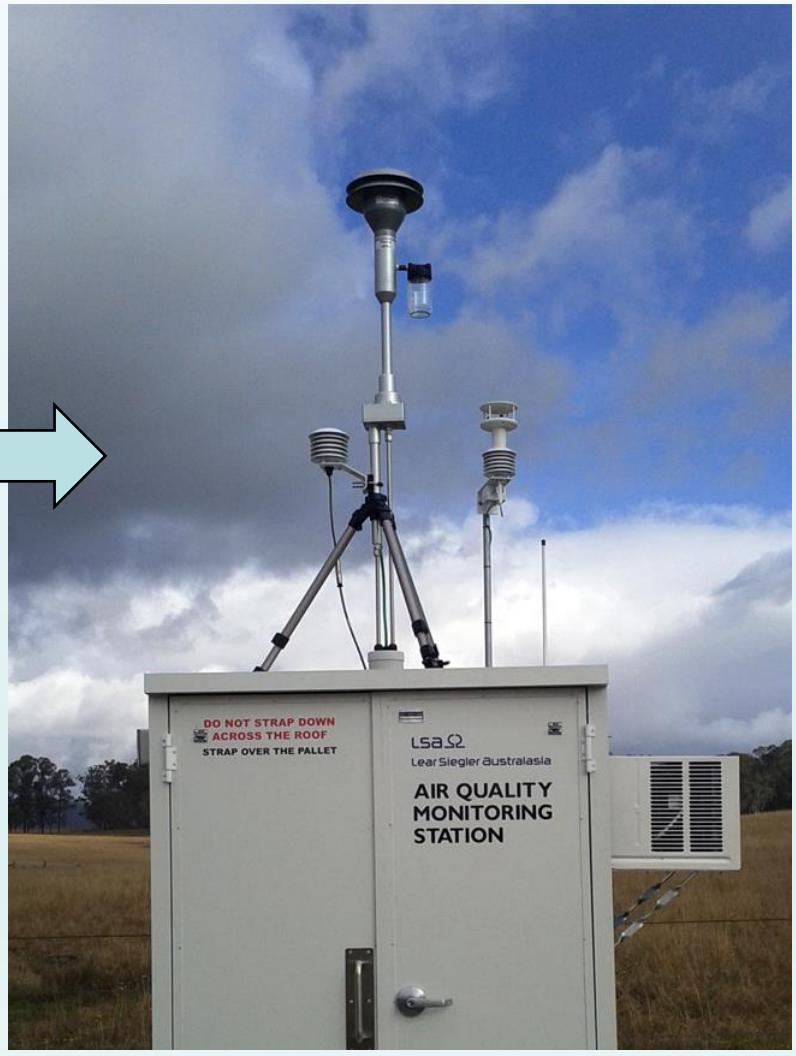
- You are a major **OR** minor source
- Emissions submitted do not demonstrate protection of Air Quality standards
- Examples:
  - Poor dispersion
  - Close proximity to sensitive groups
  - Potential existing problems in the area

What is modeling and how is it done?

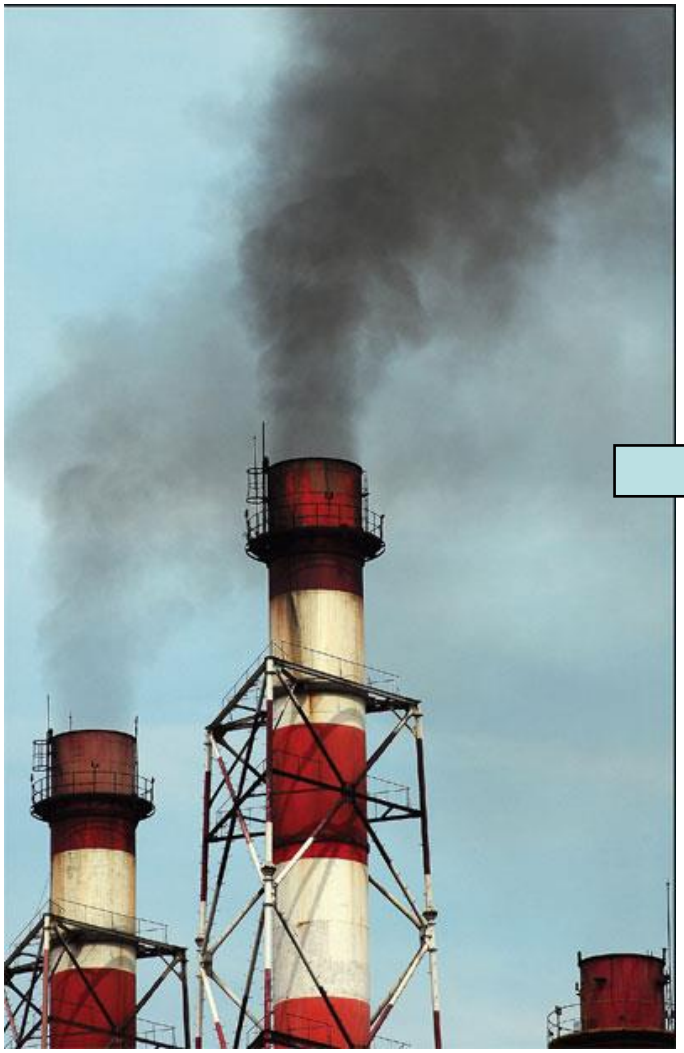
Mission: Determine Impacts from Emissions

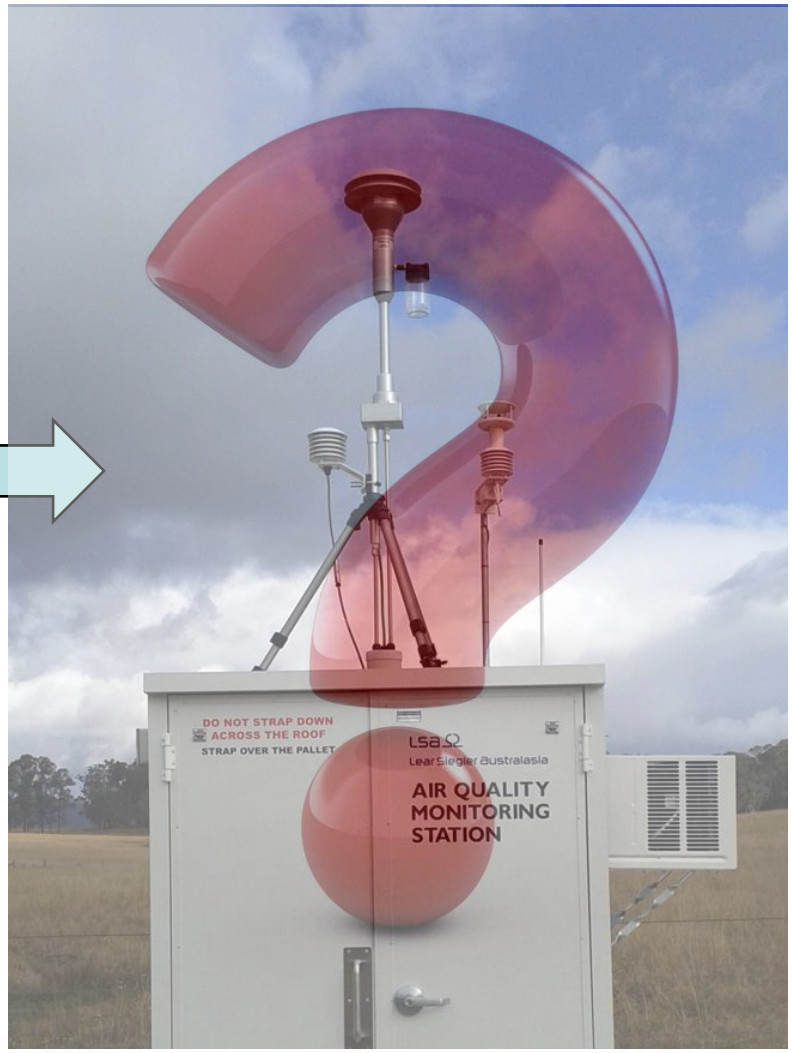


Measuring Impacts: Pre-Permit/Construction

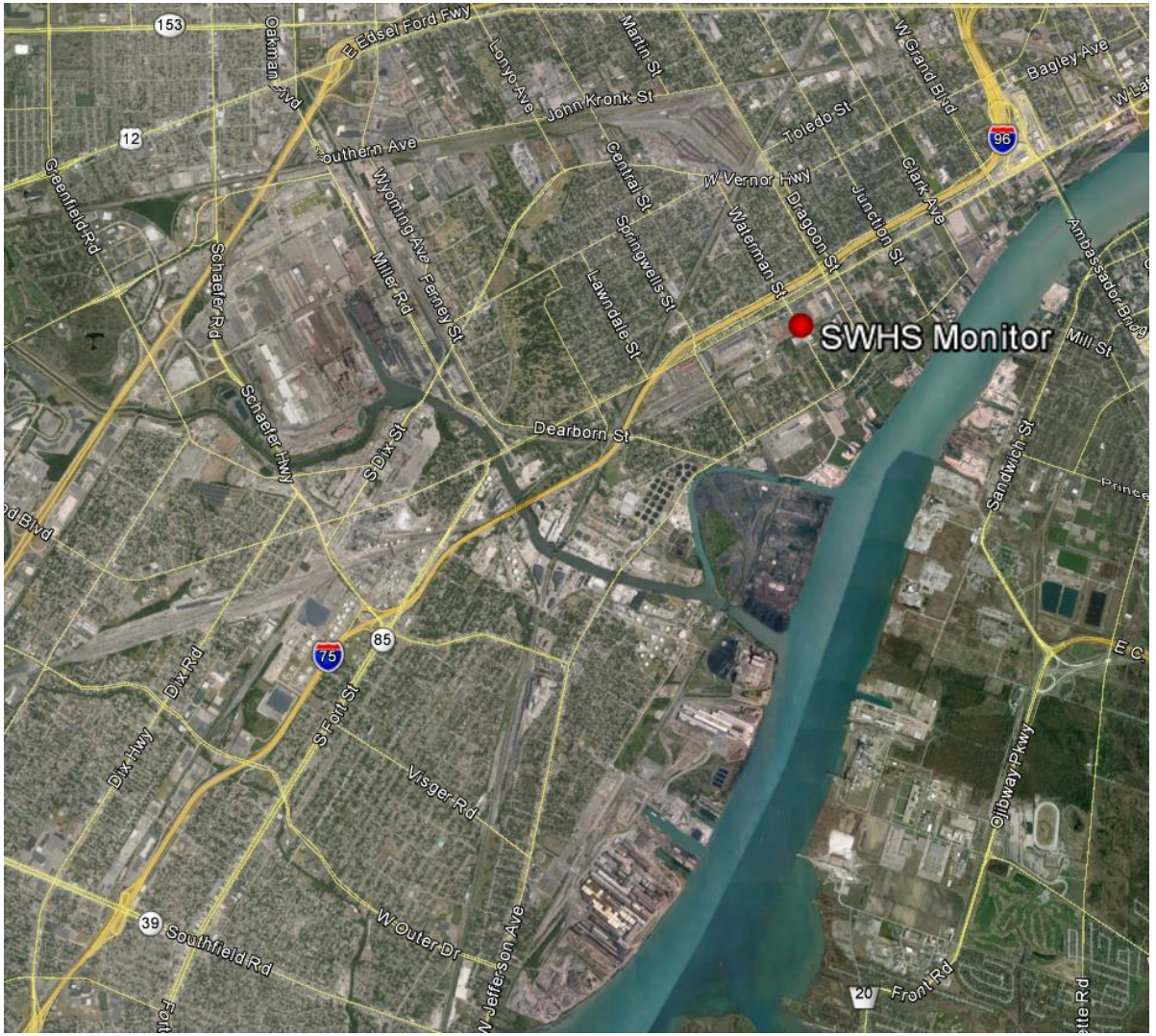


Measuring Post-Permit Impacts: Where to Locate?





Monitor Impacts: Coverage

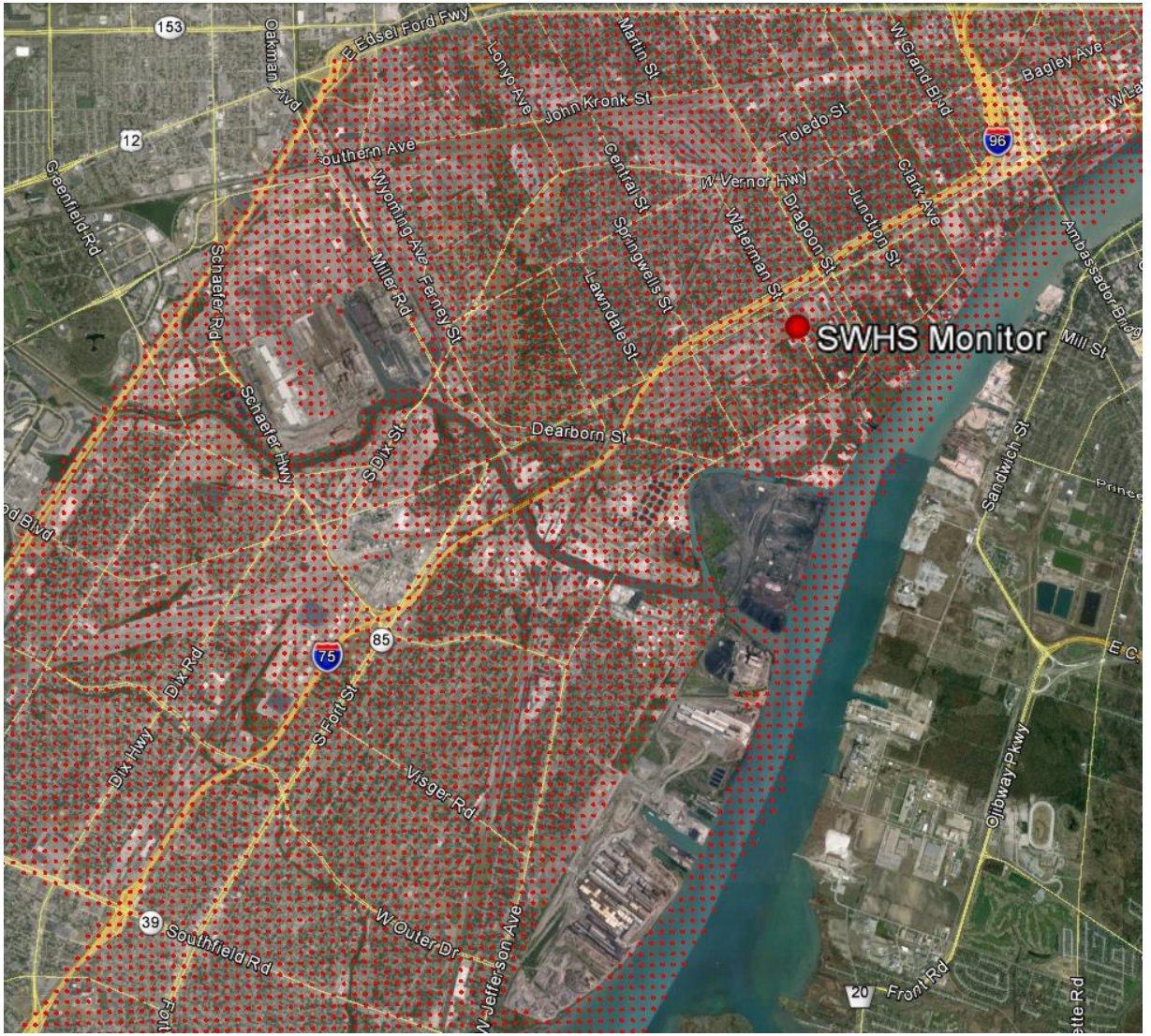


Monitor Impacts: Coverage

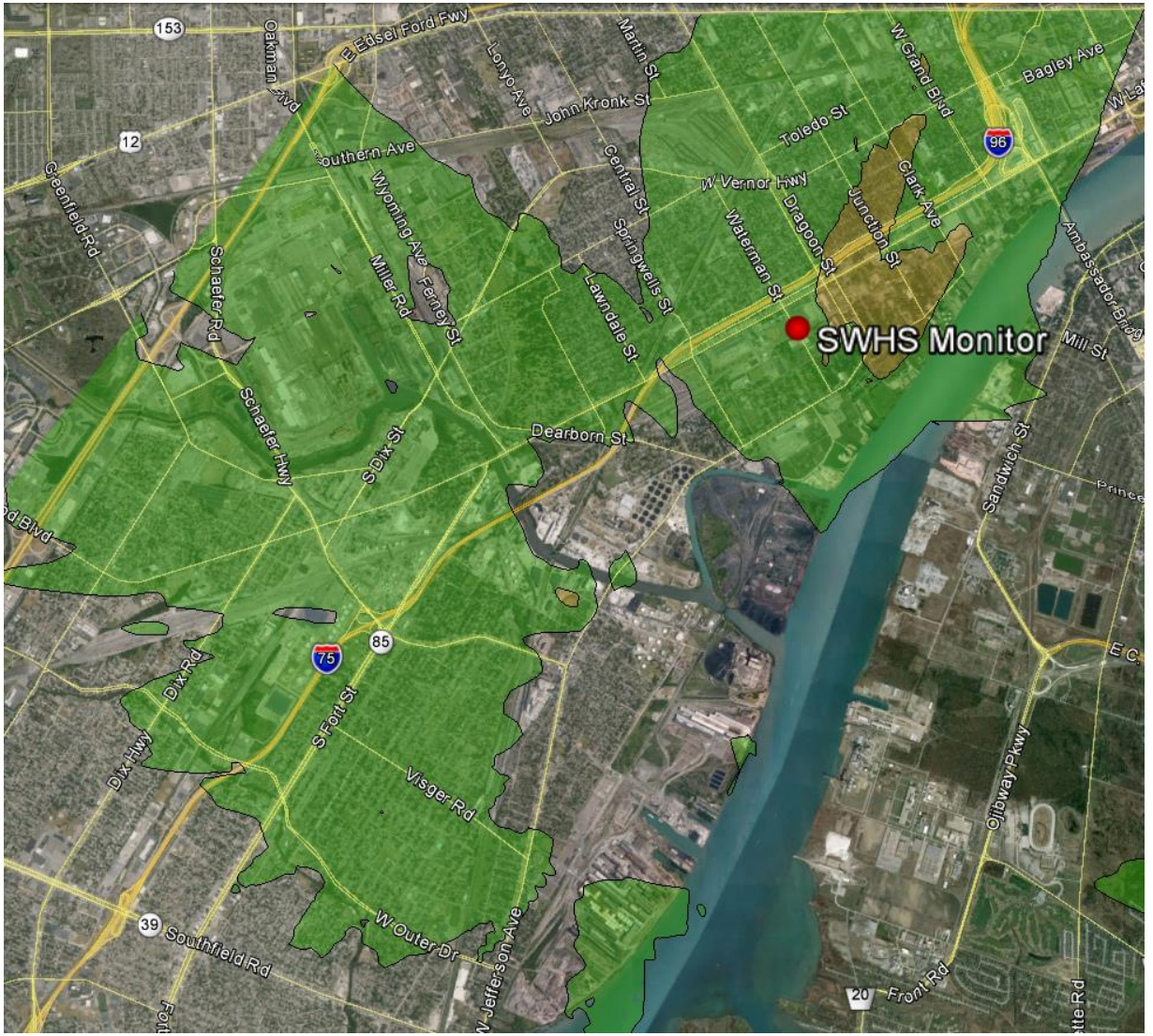
Can AQ Models Help With These Problems?

Air Quality Models are Computer Simulations of Pollutants in the Atmosphere

Virtual Monitors Over Entire Affected Area



Predicting Locations & Magnitude



Basic Modeling Elements:

Stack Parameters

Meteorology

Building Wake Effects

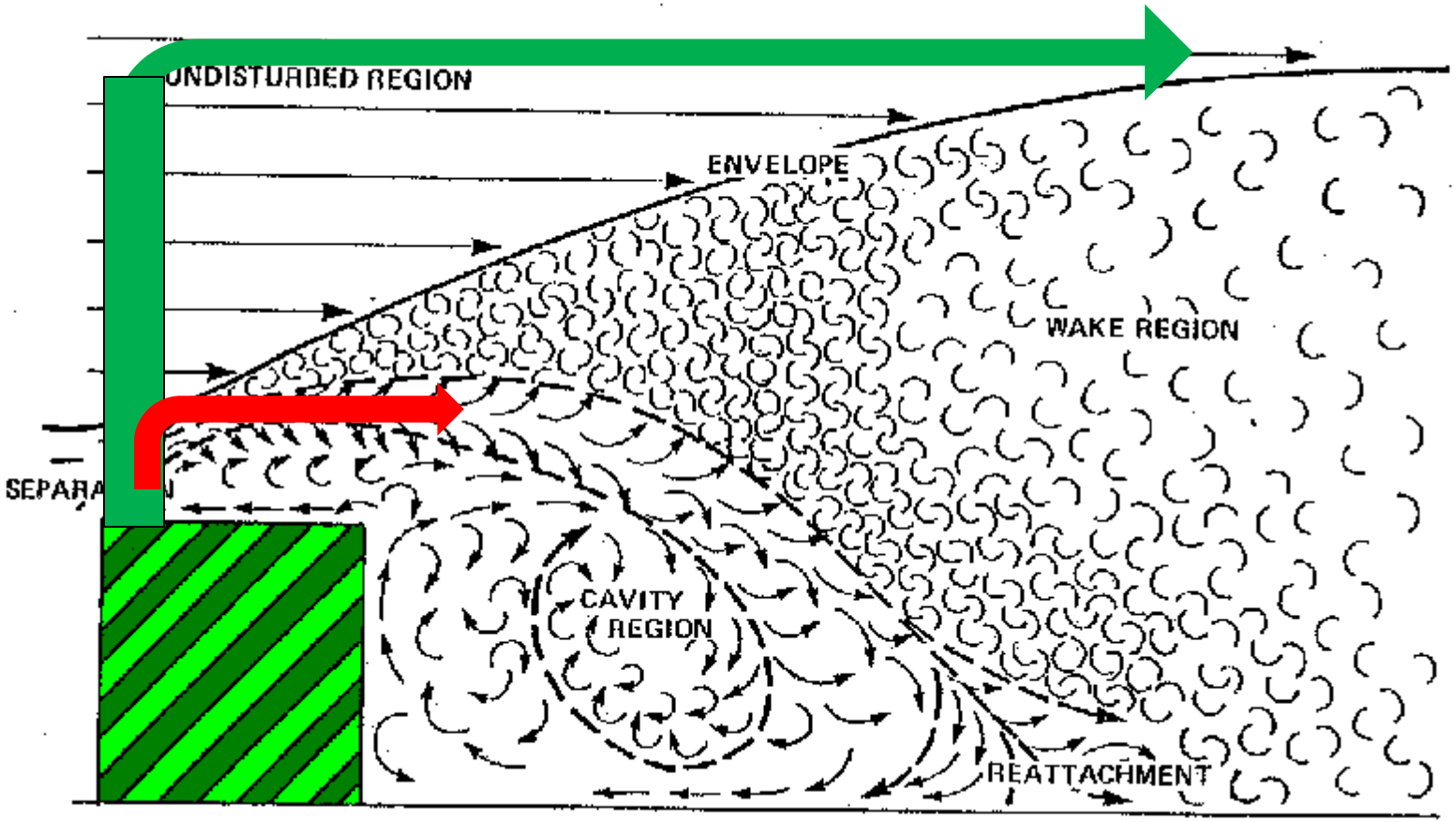
Terrain Features

Stack Parameters

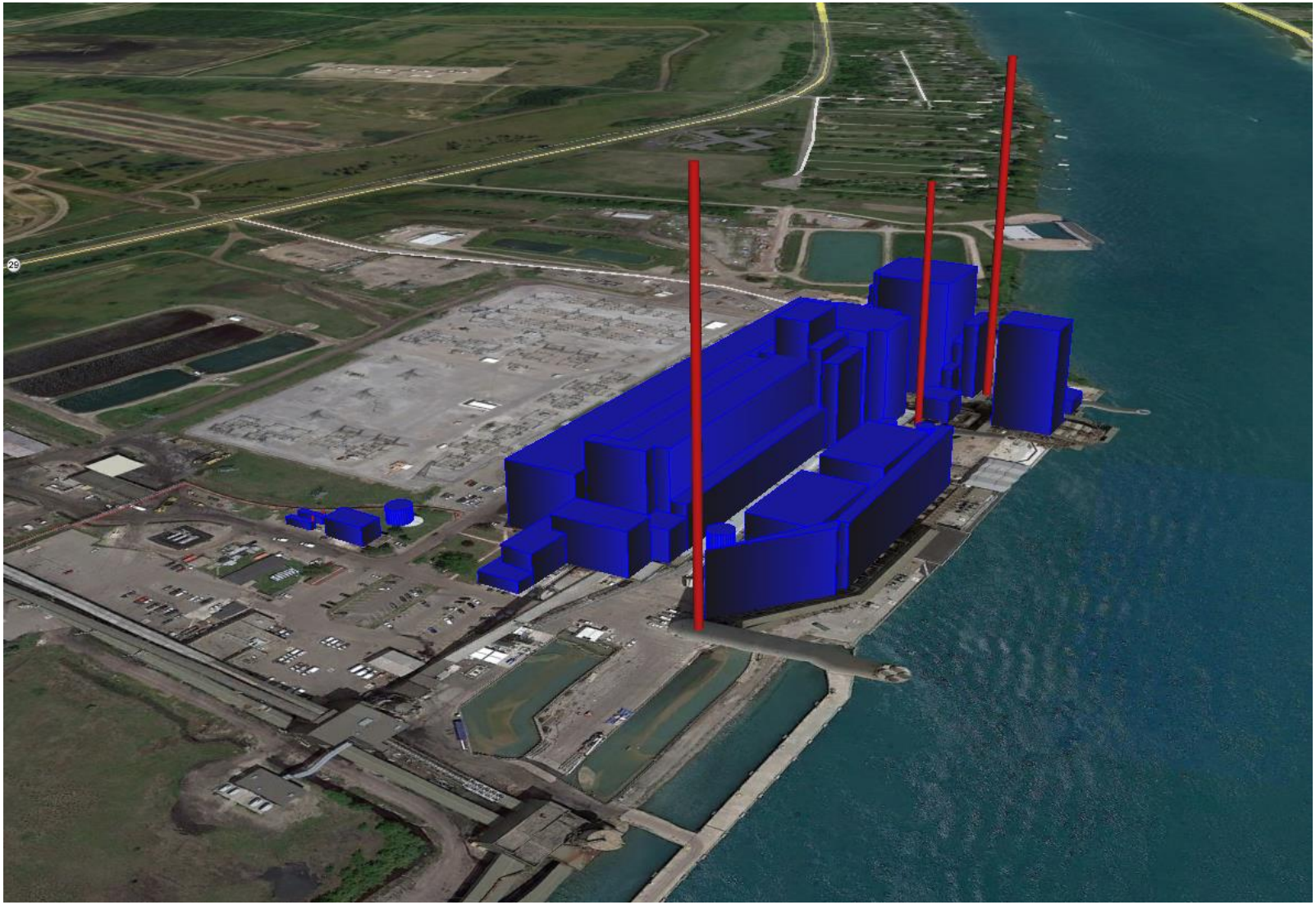
- Emission Rate
- Stack Height
- Temperature
- Stack Diameter
- Flow Rate
- Stack Orientation

Stack Orientation

Building Wake Effect



Building Wake Effect

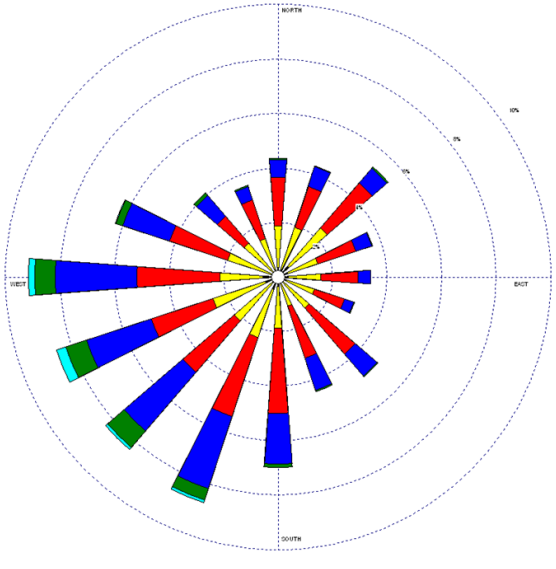


Meteorology

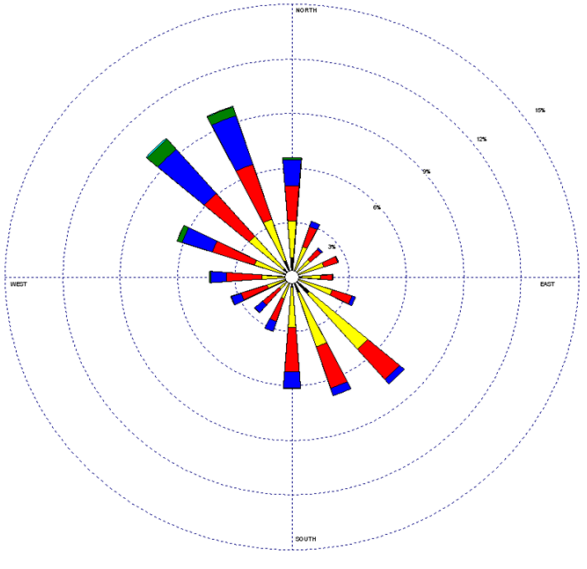
- Wind Speed
- Wind Direction
- Temperature
- Precipitation
- Upper Air Data
- Surface Features
- Representativeness

Meteorology Representativeness

Meteorology Representativeness



LANSING



IRON MOUNTAIN

Wind Direction

Terrain Features

Terrain Features

There's the Devil in the Details…

Other Considerations…

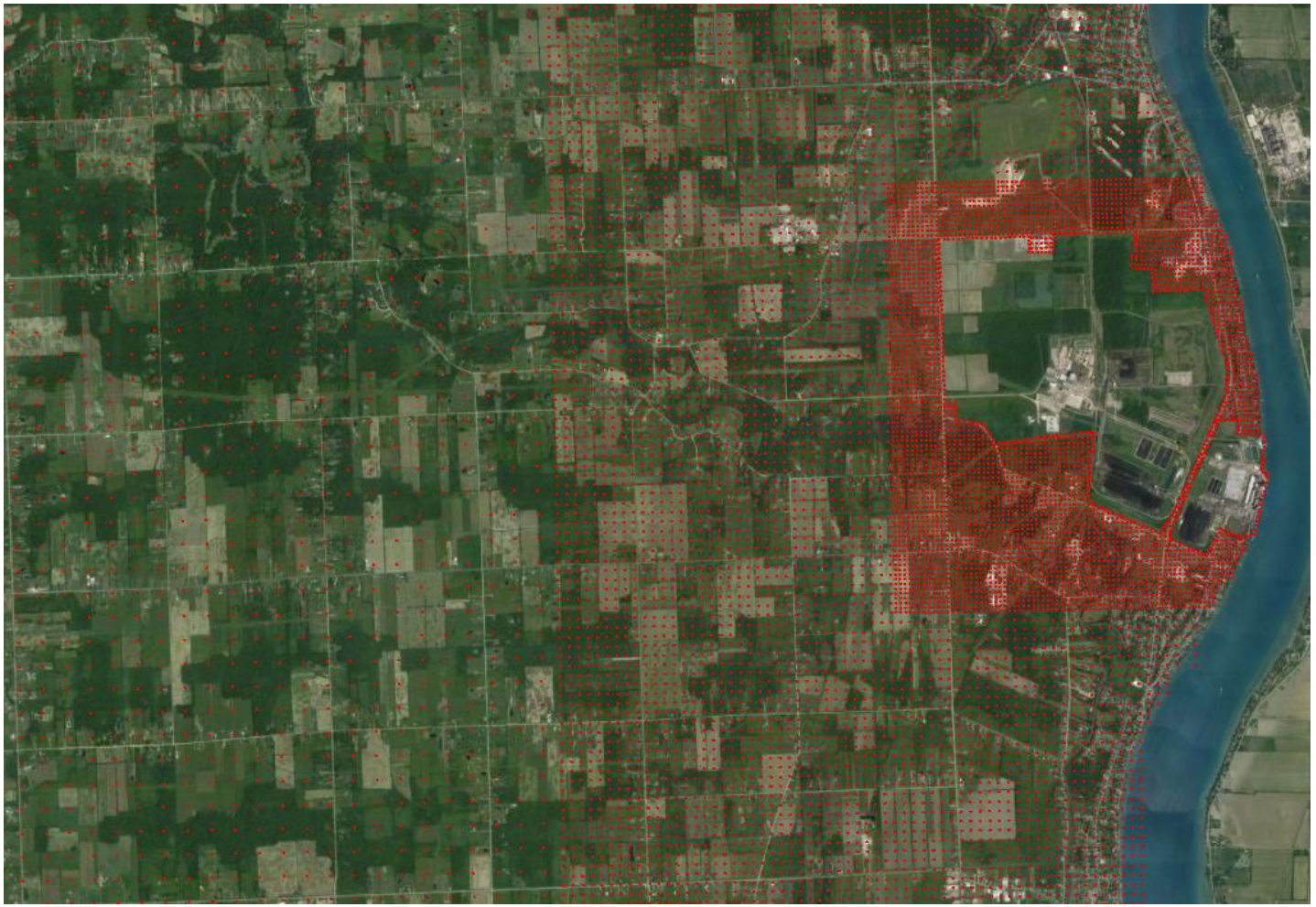
- Ambient Air
- Receptor spacing
- Fugitive Dust
- Secondary Pollutants
- Background Concentration
- Other Nearby Sources
- Additional Impacts

Ambient Air: Where Do You Model?

"the portion of the atmosphere, external to buildings, to which the public has general access"

Receptor (Virtual Monitors) Spacing

Area Coverage and Spacing Sufficient to Identify the Location and Magnitude of the Highest Ambient Impact



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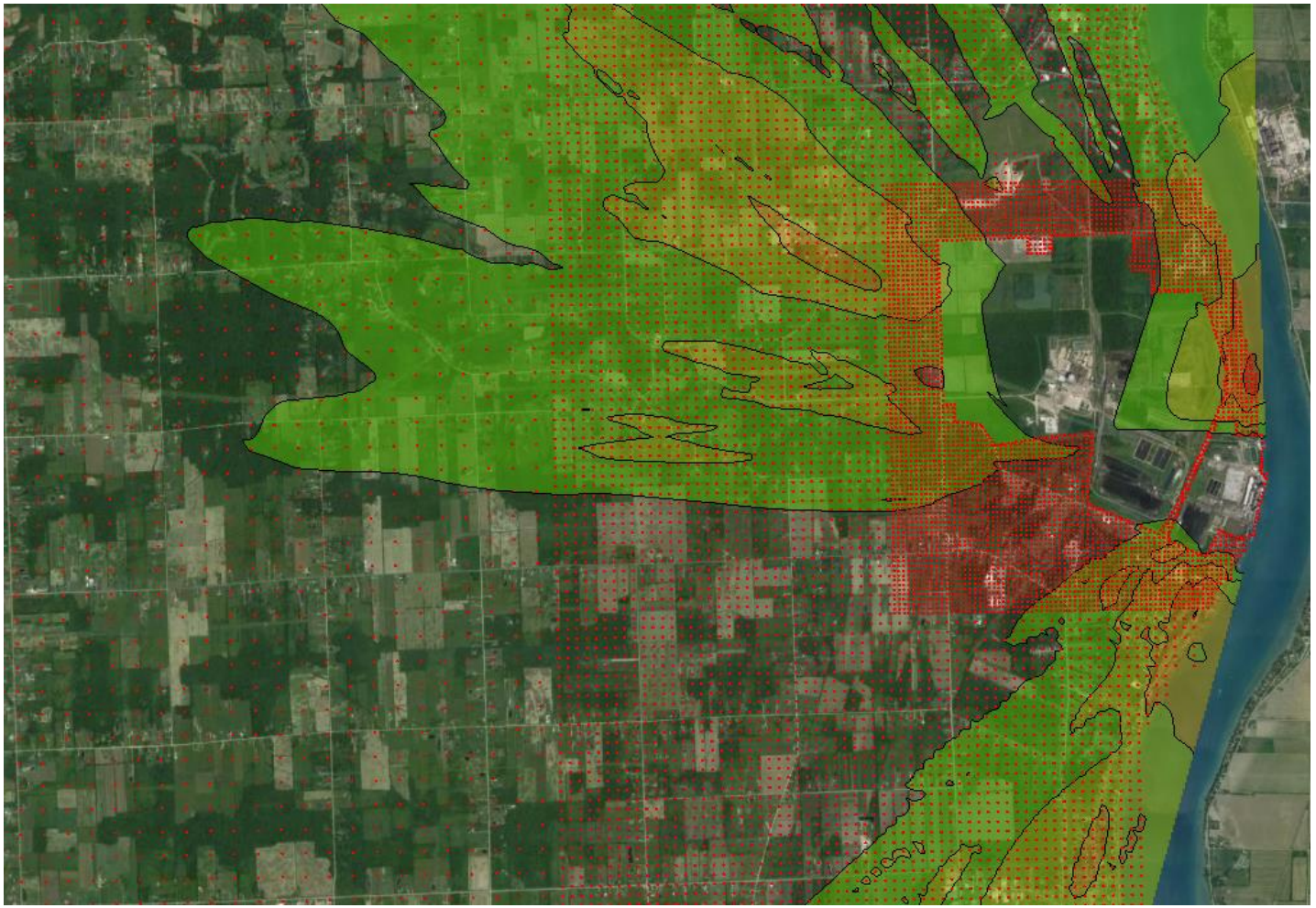
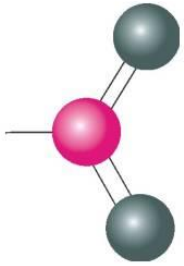


Fugitive Dust Modeling

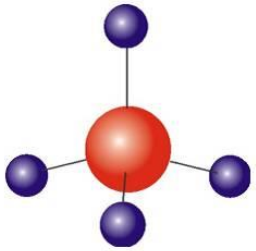
Secondary Pollutants: O_3

Formation of Ground-level Ozone

Oxides of Nitrogen (NOx)

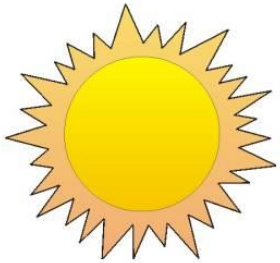


- AND -



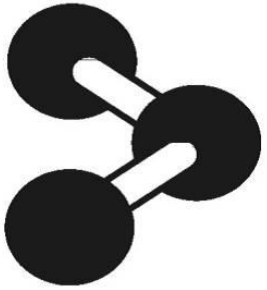
Volatile Organic Compounds (VOCs)

=>



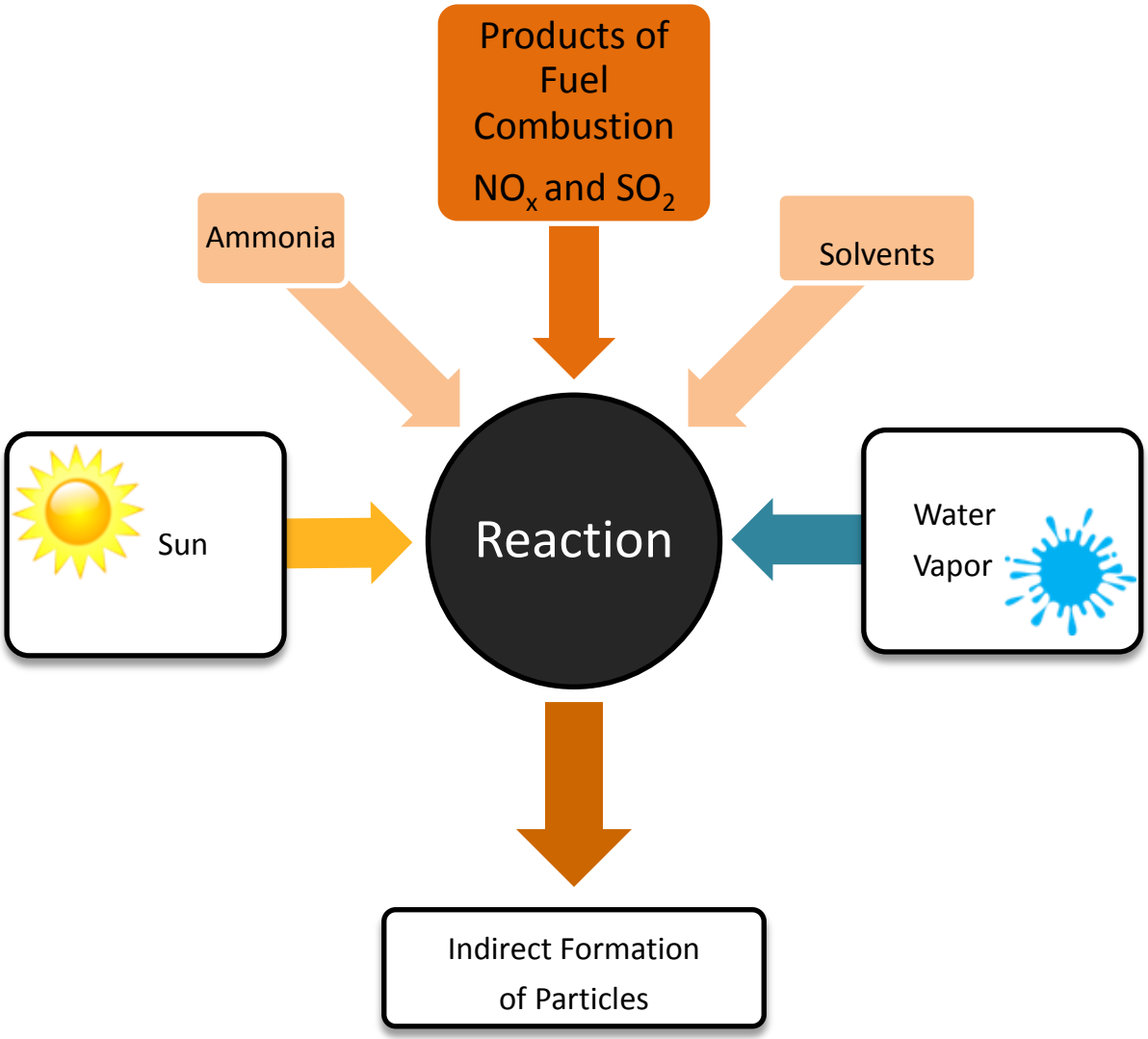
Strong Spring or Summer Sun
(with low RH & light winds)

=>



Ozone (O_3)

Secondary Pollutants: $PM_{2.5}$



Total Ambient Impact

Total Impact is *Your* Proposed Process

PLUS

Nearby Sources + Background

Additional Impacts

Soil Deposition

Vegetative Damage

Fogging and Icing

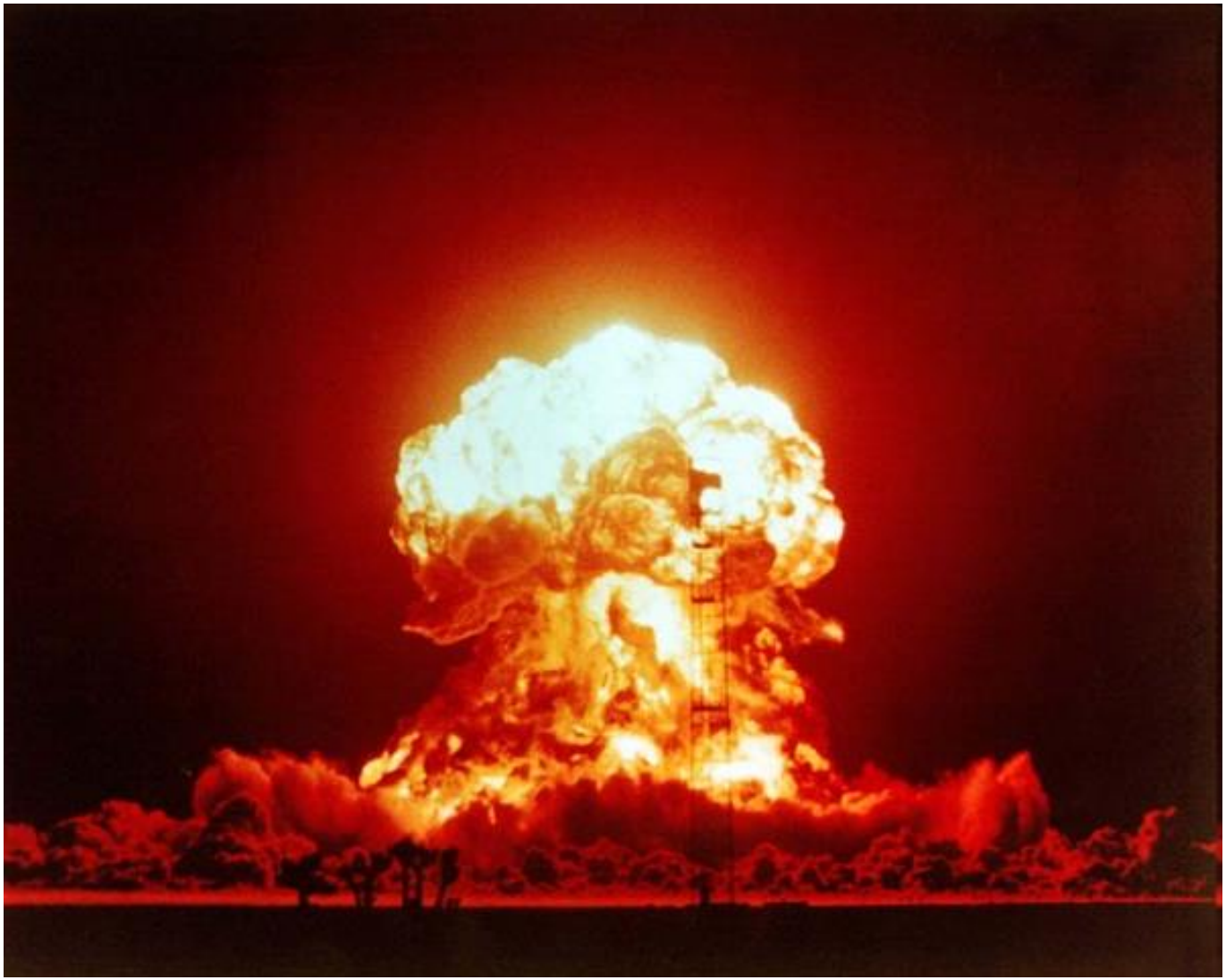
Odors

CREATE AN INPUT FILE FOR THE MODEL

RUN THE MODEL

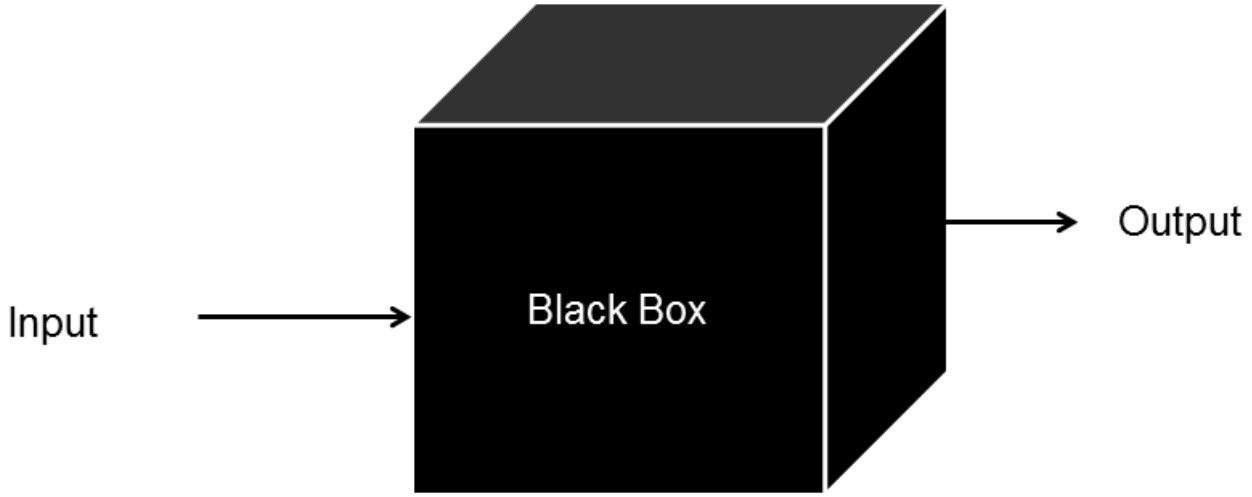
Model Predictions Pass: Permit Process Continues!

Model Predictions Fail: Then What?!?!?



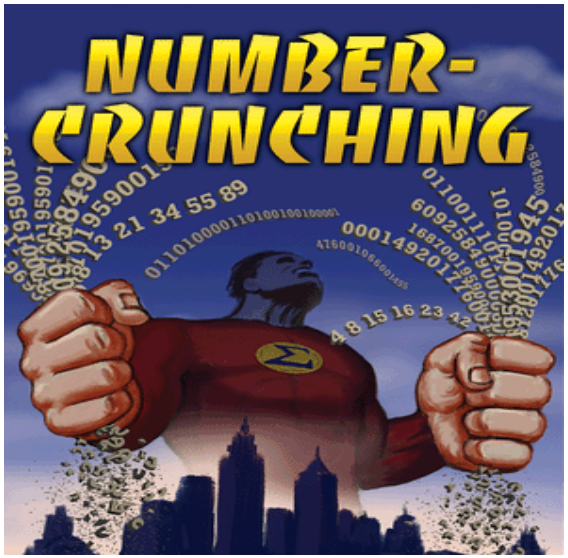
Model Predictions Fail: Reduced Impact Strategies

How Accurate Are the Models?



Internal behavior of the code is unknown

AERMOD: EPA Preferred Model



- Steady state plume dispersion model for assessment of pollutant concentrations from a variety of sources;
- Simulates transport and dispersion from multiple points, area, and volume sources;
- Employs hourly sequential meteorological data to estimate concentrations for averaging times ranging from one hour to one year.

AERMOD SOFTWARE

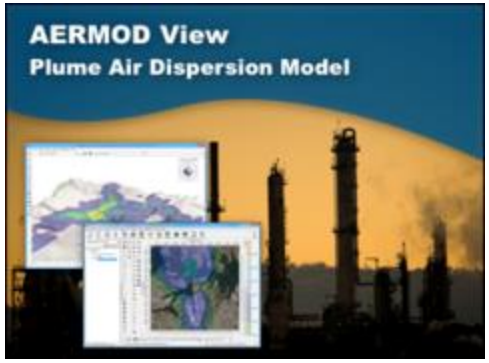
EPA

$Free

AERMOD SOFTWARE

BEEST
TAME YOUR DATA

BEE-LINE Software
$1,350



Lakes Environmental
$1,599

breeze

Breeze Software
$1,495

QUESTIONS???

What's Coming Up?

Stack Testing: What is it and why is it necessary?

February 24, 2016 at 10:00AM

Air Monitoring: History and Rationale

March 16, 2016 at 10:00AM

Please join us!

Wrap Up

- Recording
- Materials
- Evaluation

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